

# MEMORANDUM

**SUBJECT:** Request to Conduct an Engineering Evaluation/Cost Analysis for the Johnny M Mine Area Site, near San Mateo, McKinley County, New Mexico

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Removal Team (6SF-PR)

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**THRU:** Ronnie D. Crossland, Associate Director  
Prevention and Response Branch (6SF-P)

**TO:** Carl Edlund, Division Director  
Superfund

## I. PURPOSE

The purpose of this Approval Memorandum is to request and document approval to conduct an engineering evaluation/cost analysis (EE/CA) for a non-time critical removal action proposed for the Johnny M Mine Area (Site), McKinley County, New Mexico.

The proposed EE/CA is expected to be a potentially responsible party (PRP) lead action. The PRPs are Hecla Limited and New Mexico Land, LLC, hereinafter referred to as the Respondents in the Approval Memorandum. The EE/CA document and other actions required in compliance with any settlement agreement will be conducted with oversight by the U.S. Environmental Protection Agency (EPA) to ensure that the Respondents' actions are conducted in accordance with applicable laws, regulations, and EPA policy and guidance.

This action meets the criteria for initiating a removal action under the National Contingency Plan (NCP), 40 CFR 300.415.

## II. SITE CONDITIONS AND BACKGROUND

CERCLIS ID: NMN000607139

Site ID: A6AH

Latitude: 35.361959

Longitude: -107.7211956

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#### A. Site Location

As shown in Attachment 1 [Isn't Attachment 1 always the confidential Enforcement Attachment?], the Site is located approximately 4.4 miles west of the Village of San Mateo and approximately 1 mile north of New Mexico Highway 605, McKinley County, New Mexico.

#### B. Site Description

The Site (See Attachment 2[renumber?]) is the location of a former underground uranium mine, Johnny M (JMM), the associated surface support areas for the mining operations and those adjacent areas outside of the “foot print” of the support areas that were contaminated by operations from the support areas. The scope of this memorandum only addresses the radiological contamination associated with the surface support areas and the aforementioned adjacent surface areas that have become contaminated. The underground mining operations are specifically excluded from the scope of this document. The following information is a historical description of Site operations based on available federal and State government regulatory records. According to historical information obtained from the New Mexico Environment Department (NMED) and/or the United States Nuclear Regulatory Commission (NRC) records, the JMM is an underground uranium mine operated by Ranchers Exploration and Development Corporation (Ranchers) from 1972 until 1982. In 1984, Ranchers merged with Hecla Limited. No uranium ore milling was performed on the mine property. The uranium ore was transported approximately nine miles, via a haul road across the Site to the Kerr McGee Ambrosia Lake uranium mill for processing.

In 1977, Ranchers made an urgent request to the New Mexico Environmental Improvement Division (NMEID) to pump slurries of uranium mill tailings into the non-operational underground structures of the mine to prevent the mine from being overcome by groundwater. This action was approved by NMEID and the activities were regulated through a Radioactive Material License, NM-RED-MB-15, issued to Ranchers. As part of the regulatory approval, Ranchers was required to apply for a surface water discharge permit for the JMM. The mine produced approximately 1,000,000 gallons of water per day. These uranium mill tailings that were utilized for the slurry originated from the Kerr-McGee Ambrosia Lake uranium mill (NRC Source Material License SUA-1473).

By the slurring and injection process, approximately 286,000 tons of uranium mill tailings were placed in the JMM as part of the groundwater infiltration abatement process or the subsequent mine closure operations. The uranium mill tailings were trucked from the aforementioned uranium mill and placed into one or more staging or stockpile areas within the current Site boundary, then mixed with discharge water from the mine in one or both of the surface impoundments for the JMM. This slurry was then pumped into the mine at two locations,

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which are designated as the north vent hole and the south vent hole.

In late 1986, the NMEID relinquished its licensing authority for uranium mills back to the NRC. In 1987, the NRC issued Source Material License SUA-1482 to Hecla to complete the closure of the JMM. Closure operations were completed in 1987 and the NRC terminated Source Material License SUA-1482 in 1993. NRC license closure operations were confined to a one-acre tract that was used for mixing of the aforementioned slurry. No other support operations and storage areas of radiological containing substances were addressed during the NRC closure process.

### C. Site Ownership

The Site is composed of the surface support areas for the underground mining operations at the JMM and/or adjacent areas not within the defined area of the JMM minerals lease that were impacted by the mining or mining support operations. Ranchers Exploration and Development Company held the mineral lease to develop and operate the JMM from 1972 until it closed in 1982. Ranchers Exploration and Development was merged with Hecla Mining in 1984. The minerals lease that contains the JMM is composed of Section 7, Township 13N, Range 8W and the east ½ of Section 18, Township 13N, Range 8W. The main JMM shaft and a significant amount of support areas, including the shaft water settling and treatment ponds are located in the east ½ of Section 18, Township 13N, Range 8W. A limited amount of underground mining along with associated surface support areas was conducted in Section 7, Township 13N, Range 8W. Both of these areas are located on property owned by the (b) (6). The west ½ of section 18, Township 13N, Range 8W while not part of the JMM mineral lease, it did become impacted by various surface support operations conducted by the JMM. This property (New Mexico Land parcel) was purchased by New Mexico Land, LLC in April 2012 as part of a settlement agreement with the former owner. With permanent relocation of the former resident/owner of the and his small business from the New Mexico Land parcel, the removal action initially characterized as an emergency removal can be continued as a non-time-critical removal action. .

## III. NATURE AND EXTENT OF CONTAMINATION

**[[The NTC removal guidance, p. 22, advises developing a conceptual site model as the starting point for the analysis that identifies potential releases, potential areas of contamination, chemicals of concern, possible routes of exposure, possible routes of contaminant transport, and potential exposure pathways. Would it be possible to plug in a few more paragraphs in this section that document what we already know about, e.g., mill tailings as road bed, mill tailings in the mine shafts possibly influencing ground water, the arroyo that drains off the property at the southern end, the pipe that took site contaminants off-site, basically all the different things we have documented to date about ways contamination might be leaving the site? That puts the burden on the PRP to explore**

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**all those individual sources of contamination or tell the public in the EE/CA why they aren't going to do it. Do you also have the results from Lisa's sampling event, that might be a basis for documenting off-site releases?]]**

A. EPA Radiological Assessment

In November 2010, the Environmental Protection Agency, Region 6 Prevention and Response Branch (EPA PRB) received a request for assistance in the evaluation of this Site for potential removal action from the State of New Mexico Environment Department (NMED). Documentation provided by the NMED indicated that the site was adjacent to a former underground uranium mine. This property was thought to be potentially contaminated with uranium mine waste or uranium mill tailings originating from the mining and/or mine closure operations on the former mine. Based on this information, the Superfund Technical and Response Team (START) III contractors were tasked by EPA PRB to conduct a Radiation Removal Assessment on the Site. As part of this radiological assessment a quality assurance sampling plan (QASP) was developed for the project documenting standard operating procedures (SOPS), assessment protocols, and data decision tree consistent with current EPA guidance and other best management practices.

The elevated concentrations of several radio-isotopes and their associated progeny in uranium mine/uranium mill waste and soil/debris that has become contaminated with the aforementioned radioactive waste materials ("waste materials, hereafter to mean all of the waste types previously described) are contaminants of concern on this Site primarily from gamma and other forms of ionizing radiation associated with these radio-isotopes. Principally, the contaminant of concern is radium-226 ( $^{226}\text{Ra}$ , hereafter to mean isotope and progeny) primarily from the mill waste associated with mining operations and subsequent mine closure operations conducted on the JMM. In addition to  $^{226}\text{Ra}$  contamination, uranium-238 ( $^{238}\text{U}$ , hereafter to mean, all the isotopes and their progeny) generated from various mining operations associated with the JMM, including surface discharge of mine process water and the transport of ore across the Site, is also of concern on this Site. These radio-isotopes have been dispersed by anthropogenic means throughout the surface and near surface soils present on the Site. The elevated concentrations of radio-isotopes and associated radioactivity above normal background levels, expressed in counts per minute (CPM) and micro-roentgens per hour (micro R/hr) present on the Site appear to be the direct result of the uranium mining and/or mine closure operations conducted within the boundaries of the Site.

The EPA limited its surface radiological survey on the Site to the New Mexico Land parcel because the property owners of the adjacent properties associated with the JMM had denied voluntary access to the property. Hecla subsequently gained access to these properties and conducted a Site Investigation which is discussed in Section III.B, below. Surface radiological surveys have been conducted utilizing a 2"x 2" gamma scintillation detector. Gamma radiation

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levels near the residence and the former small business infrastructure were as high as 500,000 CPM, as compared to the EPA established area specific background of 10,016 CPM. Gamma radiation exposure data collected on the Site ranged as high as 2,000 microR/hr as compared to background levels of approximately 15 microR/hr. (See *Interim Status Report, Johnny M Mine Area Uranium Structures Removal Assessment April 6, 2011*, Attachment 3)

Uranium-238 and  $^{226}\text{Ra}$  are also principal contaminants of concern on this Site based primarily on the gamma and other forms of ionizing radiation associated with these radioisotopes. Radiological dose is measured in milli-rem per year (mrem/year). The *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, August 22, 1997 (OSWER Directive 9200.4-18) established a general, maximum acceptable radiological dose level of 15 mrem/year above background level for non-NRC licensed facilities. Further, this guidance document states that the total effective dose equivalent (TEDE) of 15 mrem/year represents an excess cancer risk of  $3 \times 10^{-4}$ , and is considered essentially equivalent to the CERCLA presumptively protective excess cancer risk level of  $1 \times 10^{-4}$ . The referenced risk calculation utilizes a 30-year exposure period per lifetime and a 24 hour/day exposure rate. The risk calculation is based upon a risk conversion factor of 7% cancer incidence per 100 rem of exposure and comes from the National Academy of Sciences report on *The Biological Effects of Ionizing Radiation (BEIR V)*, 1990. The *Protocol for Uranium Home Site Assessment, Grants Mineral Belt Uranium Project; Cibola and McKinley Counties, New Mexico, December 2009*, documents the regulatory consistency with EPA 1997, OSWER 9200.4-18 and the process used for conducting the radiological assessment on this property.

[[I don't think we put an action levels and cleanup levels into the Approval Memo. Judging from the guidance, it seems like that is something they work through and make recommendations in the EE/CA. The final determinations then go into the Action Memo for the non-time-critical removal action. Rather than discussing the action/cleanup level for this site particularly, we might say something here that in the course of the removal assessments under the Five Year Plan, Region 6 has routinely used 3.5 pCi/g because it is the equivalent....That way, Hecla has some guidance about what we've determined for other sites, but it leaves the door open not to pre-determine the level for this site before the EE/CA is done. Does that make sense?]] For this Site, both the action level and cleanup level is 3.5 pCi/gram of  $^{226}\text{Ra}$  in the contaminated waste materials and soils. This concentration value is the equivalent of a  $3 \times 10^{-4}$  excess cancer rate as calculated by the DOE Residual Radioactive model (ResRad) and EPA's preliminary remedial goals (PRG) calculator using site specific data where possible. Further, this concentration value is also the equivalent of a 15 mrem/yr dose rate for ionizing gamma radiation generated from the decay of the aforementioned radioisotopes and their associated daughter progeny in the contaminated re-purposed materials and soils.

In developing the action levels and cleanup levels for the Site, EPA Region 6 considered the *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, August 22, 1997 (OSWER Directive 9200.4-18), EPA Region 9 Navajo Nation Radiological Structure Assessment data and procedures, and consulted with NMED to determine whether there were Request of Approval of an EE/CA at the Johnny M Mine Area Site, McKinley County, New Mexico

potential state Applicable or Relevant and Appropriate Requirements (ARARs) within the meaning of CERCLA Section 121, 42 U.S.C. § 9621. After the action levels and cleanup levels for this Site were reviewed and found to be consistent with historic action levels and cleanup levels used by the EPA on similar sites, the OSC decided to utilize the aforementioned ionizing radiation concentration of 3.5 pCi/gram of  $^{226}\text{Ra}$  and the equivalent dose rate as the action level and cleanup level for the radiological contamination on this Site. ]]

As previously stated, the primary contaminants of concern at the Site,  $^{238}\text{U}$  and  $^{226}\text{Ra}$  and their associated progeny, are hazardous substances as defined in Section 101(14) of CERCLA, 42 U.S.C. 9601 (14) and 40 CFR 302.4. The following are the known health effects associated with exposure to the aforementioned hazardous substances on the Site.

### **Radium-226**

Radium-226 is principally a source of alpha and gamma radiation, although some beta radiation is also produced during the decay process. According to the ATSDR *ToxFAQs for Radium* (July 1999) document, exposure to  $^{226}\text{Ra}$  can cause adverse effects to the eyes (cataracts) and blood (anemia). Radium-226 has been identified by the EPA and the National Academy of Sciences as known human carcinogen, being specifically linked to cancers of the bone, breast and leukemia.

Exposure pathways are the routes that a contaminant can take in order to be assimilated by a human or animal. For example, incidental ingestion of contaminated soils through direct contact or the inhalations of contaminated airborne particles (dust) are both exposure pathways. The exposure pathways of concern at the Site are described below:

The predominant exposure pathway related to  $^{226}\text{Ra}$  was determined to be external gamma radiation, contributing over 90% of the total effective dose equivalent (TEDE) in the DOE ResRad modeled scenario utilized for the EPA radiological assessment.

A significant amount of the surface area of this Site is contaminated with elevated concentrations of  $^{226}\text{Ra}$  at or near the surface. The contaminated soils are fine grained and have a high probability of adherence to skin, clothing and fur as a result of direct contact. For humans, incidental ingestion of the contaminants adhering to skin or clothing can occur through normal hand-to-mouth activities such as play or mealtime.

Inhalation is another exposure pathway at this Site. As discussed above a significant amount of the surface soils on this Site are contaminated with  $^{226}\text{Ra}$ . The contaminated soils tend to be fine grained on this Site are contaminated with  $^{226}\text{Ra}$ . The contaminated soils tend to be fine grained and dusty, are easily airborne after wind or mechanical disturbances, and subject to inhalation by humans, livestock and endemic fauna.

## Uranium

Uranium is a widespread mineral forming heavy metal that in nature is composed of three isotopes  $^{238}\text{U}$ ,  $^{235}\text{U}$ , and  $^{234}\text{U}$ , with the  $^{238}\text{U}$  isotope generally composing over 98% of the mixture. All of these isotopes are the same chemically, but they have different energy and decay properties. According to the ATSDR *ToxFAQs for Uranium* (October 1999) document, U is an alpha ionizing radiation emitter and in general, weakly radioactive. Exposure to excess levels of U isotopes can cause human tissue damage, primarily in the kidneys. Cancer risk from exposure to excess levels of U isotopes appears to be low to none. The primary risk on this Site from U isotopes is cancer caused by exposure to the progeny generated by its decay.

### B. Hecla Limited Site Investigation

As part of the Administrative Order on Consent (AOC), CERCLA Docket No. 06-11-12 (attachment 4) between EPA Region 6, New Mexico Land, LLC (NML), and Hecla Limited, NML and Hecla agreed to conduct a radiological site investigation for all of the actually or potentially impacted areas associated with the JMM. As stated above, EPA's radiological assessment activities were limited to the New Mexico Land parcel due to access constraints. Hecla was able to obtain access to all potentially impacted areas to adequately assess the radiological extent of contamination over the entire potentially impacted site boundary discussed in Section II (C) above. The nature and extent of the radiological contamination present on the Site as a whole was similar and consistent with the

results reported during the aforementioned EPA radiological assessment. The Hecla Site Investigation Report (SIR), *Site Investigation Report for the Johnny M Mine and Adjacent Properties, September 2013* estimates a volume of 314,000 cubic meters of radiologically contaminated soil/debris that exceeds the aforementioned action level and cleanup level of 3.5 pCi/g of radium-226 present within the boundaries of the Site. For additional details See Attachment 5.

### C. Maps, Pictures and Other Graphic Presentations

Attachment 1 Site Location Map

Attachment 2 Figure 3-3 Site Sketch Map

Attachment 3 *Interim Status Report, Johnny M Mine Area Uranium Structures Removal Assessment April 6, 2011*

Attachment 4 *Settlement Agreement and Administrative Order on Consent for Removal Action Johnny M Mine Site Hecla Limited CERCLA Docket No. 06-11-12 August 16, 2012*

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## **VI. THREAT TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT**

Substances found at the Site, including the substances identified above in the Nature and Extent of Contamination, constitute “hazardous substances” as defined by Section 101 (14) of CERCLA, 42 U.S.C. 9601(14).

### **A. Human Health and the Environment**

The elevated concentrations of hazardous substances above the aforementioned action and cleanup levels for radium-226 indicate that human exposure pathways exist through air (inhalation) direct contact (dermal), and soil (ingestion). Nearby residents, future site residents or workers, and/or trespassers could be exposed to the contaminants.

The potential for exposure is elevated further because Site has limited vegetative cover and is located in a semi-arid portion of the State of New Mexico which is subject to severe and prolonged windstorms with wind gusts up to 55 mph commonly occurring. In addition to the windstorms, this part of New Mexico is prone to heavy episodes of flash flooding during the Monsoon Season. Both of these documented weather conditions may result in the redistribution of contaminants throughout the surrounding environment and adjacent residential properties.

Ecological receptors, including avian, mammalian, and plant receptors, could become exposed to elevated site contaminants found in soils through direct contact with the contaminated materials and with water and sediments contaminated by the materials; ingestion of soils, water, and sediments contaminated by the materials; and ingestion of contaminated food (e.g., sediment-or soil-dwelling insects, vegetation).

### **B. Expected Change if No Action is Taken**

If no action is taken, or if this is delayed:

- Hazardous substances will remain as potential human health and environmental threats based on inhalation, direct contact, and ingestion pathways; and

- Hazardous substances will remain a potential continuing source of solid airborne (dust) and dissolved/suspended phase (uncontrolled run-off) contaminants to the surrounding residential properties and San Mateo Creek.

- Surface and subsurface contamination may present continuing sources of contamination to area surface and ground water.

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## **V. Endangerment Determination**

The actual or threatened release of hazardous substances within and from the Site may present an imminent and substantial endangerment to public health, welfare, or the environment within the meaning of Section 106(a) of CERCLA, 42 U.S.C. 9606(a).

## **VI. Proposed Project/Oversight and Costs**

The EE/CA will assist with defining the scope of the removal action. Based on the analysis of the nature and extent of contamination developed as part of the EE/CA, a limited number of removal action alternatives will be identified and evaluated against the scope of the removal action alternatives to meet the EPA established cleanup objective of 3.5 pCi/gram of radium-226. The likely technology alternatives that will be subject to detailed analysis include on-site containment, ex-situ solidification /stabilization, and off-site disposal. Bench -scale treatability investigations may be conducted to provide sufficient data to allow the alternatives to be fully developed and evaluated, and to reduce cost and performance uncertainties so that a removal alternative can be selected. A final removal alternative will be selected following public comment and evaluation. Costs for conducting the EE/CA are approximately \$450,000.00 including EPA oversight. Respondents agreed to conduct the EE/CA and reimburse EPA oversight costs in the 2012 Settlement Agreement and Administrative Order on Consent for Removal Action.

## **VII. Recommendation**

Conditions at the Johnny M Mine Site meet the criteria in the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300.415, for the initiation of a non-time-critical removal action and I recommend your approval to conduct an EE/CA.

APPROVED: \_\_\_\_\_ DATE: \_\_\_\_\_

Carl Edlund, P.E. Director

Superfund Division

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